

## New process technique for photonic crystals using gas cluster ion beam

E. Bourelle<sup>1\*</sup>, A. Suzuki<sup>1</sup>, A. Sato<sup>1</sup>, T. Seki<sup>2</sup>, and J. Matsuo<sup>2</sup>

<sup>1</sup>Japan Aviation Electronics Industry, Ltd., Akishima, Tokyo 196-8555, Japan

<sup>2</sup>Kyoto University, Uji, Kyoto, 611-0011, Japan

\*E-mail: ebourelle@jae.co.jp

We present a new technique to fabricate high quality photonic crystals. In this technique, gas cluster ion beam (GCIB) is used to reduce dramatically surface roughness of photonic crystal structures. Sidewall surfaces as well as top/bottom surfaces can be smoothed by irradiating chemically reactive gas clusters nearly parallel to the sidewall surfaces, in a similar way of the parallel movement of slurries along the surface in chemical mechanical polishing [1]. We demonstrate a surface roughness at a 0.1 nm level (Fig. 1) that is drastically lower than the sidewall roughness of photonic crystals etched by conventional methods. The advantages of our technique are that GCIB polishes selectively the protruding silicon atoms, and leaves no damage on the surfaces. (This work is supported by NEDO of Japan)

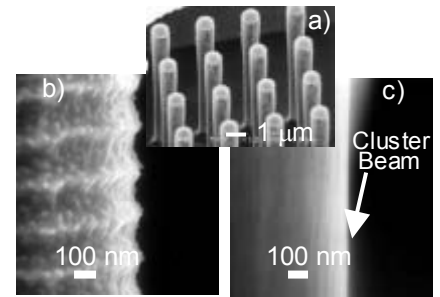


Fig. 1: Photonic crystal structures before (a and b) and after GCIB irradiation (c)

[1] E. Bourelle, A. Suzuki, A. Sato, T. Seki, and J. Matsuo, *Jpn. J. Appl. Phys.*, 43, L1253 (2004).